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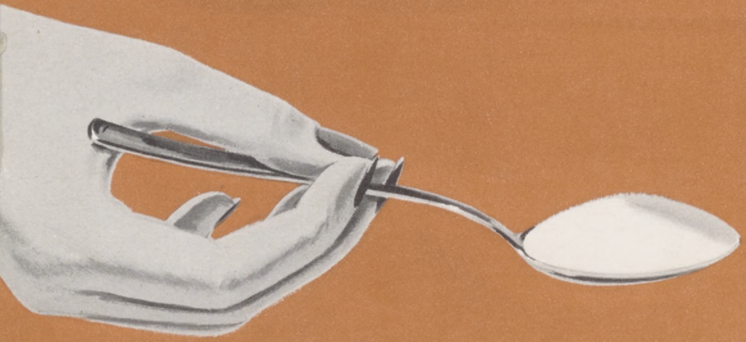

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Spreckels Sugar Company
San Francisco, California

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Sliced in two and laid open, a sugar beet reveals its silvery flesh whose juices are a nearly pure sugar solution.

"O Boy—is this good—." The taste for sweets is native; not acquired. It is the healthy body's way of calling for energy food.

THE SUGAR IN YOUR LIFE

Looks good, doesn't it? The young man in this picture might equally well have been shown sprinkling sugar on his cereal or licking an ice cream cone or drinking a bottle of pop. For in any of these situations he would be illustrating, as he is here, the enticing appeal of sugar to the taste and appetite. The universality of this appeal is recognized in the common identification of sugar with that which is pleasing to the senses. The widespread usage of sugar as a term of affection and endearment (witness the lyrics of innumerable popular songs) constitutes a tribute to the popularity of sugar as a food. Without question it is the pleasant taste of sugar that accounts for its popularity.

Sugar in the diet Less widely known is the important part sugar plays in the diet. *Sucrose,* which is the technical name for the white granulated sugar of commercial use, is but one sugar of several known to science, and sugars in turn are but one class of a type of food called *carbohydrates.*

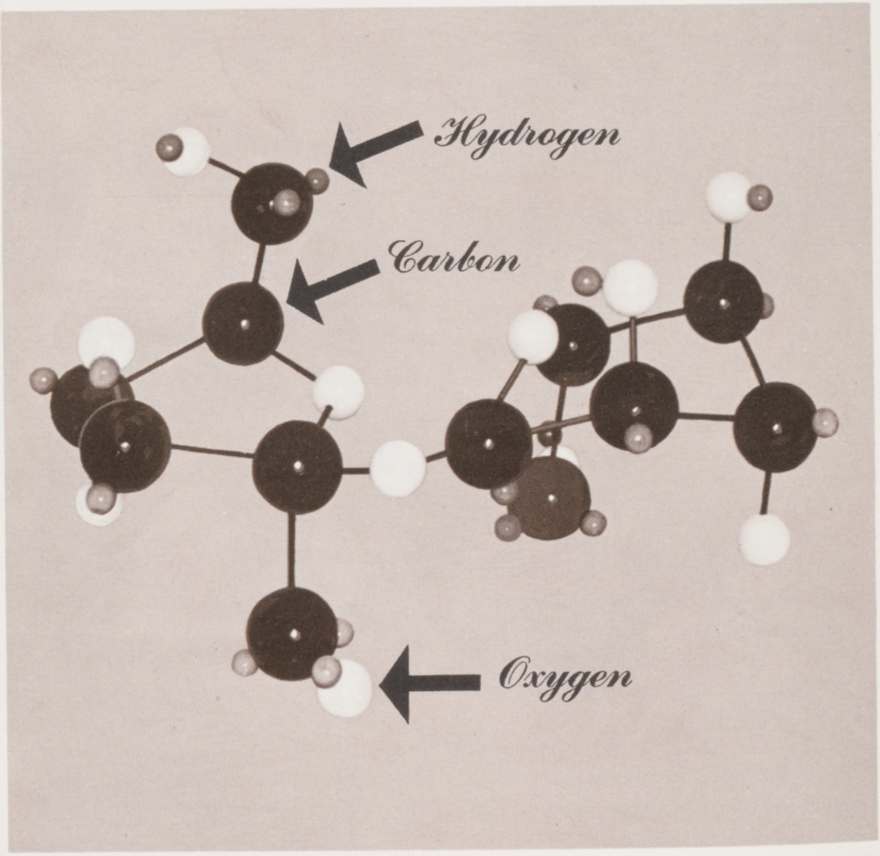
Carbohydrates, proteins, fats, minerals, and vitamins constitute the essential elements of a balanced diet, since each one of them performs a definite and unique function in nourishing and sustaining the body. The role of carbohydrates in the diet is to furnish the body with energy; lacking the requisite energy, an individual is not able to perform the simplest task, whether physical or mental.

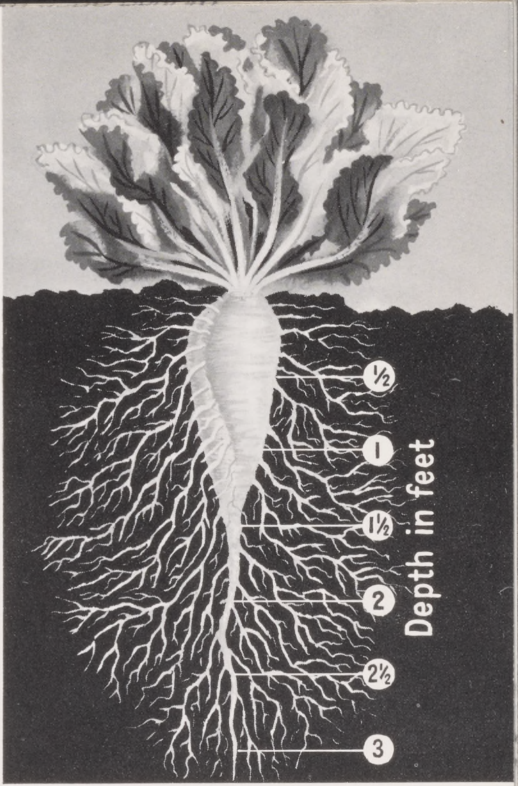
Among the carbohydrates, sucrose sugar has two claims to distinction besides its pleasing taste. First, its cost per calorie, or unit of energy, is far less than that of any other carbohydrate.

Second, because it is such a concentrated and pure (99.95%) food, it can be digested and converted into energy by the body with maximum ease and with minimum waste. For the same reason sucrose sugar is without a peer as a quick source of energy.

Value of sugar Three examples will demonstrate the value of sugar in the diet. Many athletes, either just before or during competition, like to eat either pure sugar or some sugar-containing food in order to give themselves a needed "lift." The U. S. Army, recognizing the necessity of supplying energy to men in combat or under other adverse conditions, includes hard candy and chocolate (both, of course, are extremely high in sugar content) in its emergency "K" and "D" rations. Similarly, on the several recent expeditions to Antarctica, candy has had a high priority among the foodstuffs taken along, since it is at once an efficient source of energy and a stimulant to the morale of men destined to spend long periods of time in the bleak, never-ending cold of the earth's farthest corner.

A single sugar molecule combines:
12 atoms of carbon
22 atoms of hydrogen
11 atoms of oxygen





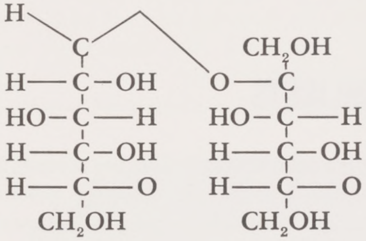
A sugar beet root draws its nutrients from the soil through multitudes of hair-roots, penetrating to a depth of 3 to as much as 6 feet.

SUGAR AND NATURE

What is sugar? It has already been noted that there are several kinds of sugar of which sucrose is one. However, because sucrose is so common a food, the term "sugar" is generally understood to mean sucrose. It will be so understood throughout the rest of this booklet.

It has also been noted that sugar is a carbohydrate. This means that it is composed of carbon, hydrogen, and oxygen; that it dissolves in water; and that it is sweet to the taste.

Chemists refer to sugar in their shorthand as $C_{12}H_{22}O_{11}$. They believe that the atoms making up one molecule of sugar are grouped together like this:



Sources of sugar Sugar beets, palm trees, maple trees, sorghum, watermelons, carrots, sugar cane—these plants all contain sugar, as, indeed, every plant does to a greater or less degree. Only the plants differ; sugar extracted from one plant has the same physical and chemical properties as the sugar extracted from any other plant. According to the United States Department of Agriculture, "By no chemical test can the pure crystallized sugar from these different sources be distinguished."

So widely found in nature, sugar has been part of man's diet since antiquity. Early man relied particularly on fruit for his sugar needs. But despite its numerous sources, only in the last few hundred years has sugar become common as a distinct food. For it has required considerable technical ingenuity to release sugar from its natural environment and make it available at prices that people the world over can afford.

Two plants, the sugar beet and the sugar cane, store sugar in far greater quantities than do other plants. For reasons of economy, therefore, they alone are relied upon for the commercial production of sugar today. Beet sugar accounts for about 40% of the world's sugar production and cane sugar makes up the remaining 60%.

The sugar beet thrives in a temperate climate, such as that of California, of the mountain states, of southern Canada, or of Europe. Sugar cane on the other hand requires a tropical or semitropical climate such as that of Cuba, of Louisiana, of Hawaii, or of the Philippines. It bears repeating that despite great differences between the appearance, the life cycle, and the native habitat of the beet and the cane, ***the sugar they yield is absolutely the same.***

The ensuing pages will briefly explain how plants make sugar, will touch on some highlights of sugar history, and will describe how the Spreckels Sugar Company produces sugar of highest quality from sugar beets grown in ***California, America's number one sugar-producing state.***

How nature makes sugar Nature forms sugar by the interaction of sunlight, air, and water in the leaves of plants. Water, which is a combination of the elements hydrogen and oxygen (H_2O), is drawn up by the roots of the plant to the leaves. Simultaneously the leaves take carbon dioxide (CO_2) out of the air. Sunlight furnishes the energy that is used by the ***chlorophyl*** (green coloring matter in the leaves) to combine carbon dioxide and water into sugar. This process is called ***photosynthesis;*** upon its completion, the resulting sugar is stored in the tissue of the plant.

Synthetic sugar Scientists have produced sugar in the laboratory by synthesis, but they have done so only at enormous expense and with great difficulty. The synthesis of sugar is useful chiefly as a means of introducing tracer elements into a food for biological studies. For nutritional purposes mankind continues to depend upon plants—specifically sugar beets and sugar cane—for his sugar.

HISTORICAL HIGHLIGHTS

Early sugar history History records numerous attempts to discover practical methods of producing sugar. Before the time of Christ, cane sugar was known in India and the Near East and highly prized for its delightful flavor. Introduced into Europe after the Crusades, it was enjoyed only by the wealthy, as the merchant princes of Venice monopolized trade with the Near East.

In the late 15th century when Columbus was attempting to establish a new trade route with the East he landed on the islands of the Caribbean. On his second trip he brought cuttings of sugar cane which he gave to the Indians to plant. The cane thrived in the warm, humid climate of the West Indies and was soon widely planted there. Thus Europe was apparently freed from its dependence on the Venetians for sugar.

While Christopher Columbus is well remembered for his exploration and his discoveries in the New World, another of his enduring achievements, the founding of the sugar industry in the Western Hemisphere, is largely unrecorded by historians.

A great discovery The Caribbean was far from Europe and a combination of recurrent wars and piracy served to restrict trade and to place sugar in short supply. As a result, a number of Europeans began searching for more convenient sources of sugar.

In 1747 a German chemist named Andreas Marggraf discovered that the sugar in a white beet *(Beta Vulgaris)* was exactly the same as the sugar extracted from cane. One of his pupils, Franz Karl Achard, experimented until in 1799 he found a practical way to extract sugar from this white beet. His discovery was of great importance, for the sugar beet could be grown in the temperate climate of Europe and each European nation could supply at least part of its own sugar needs. No longer would they have to rely entirely on imports from the distant tropics.

A new industry During Napoleon's tumultuous career the growing and processing of sugar beets reached commercial stature. In the early 1800's his vast empire was almost completely isolated from the rest of the world by a blockade of the British Navy. Consequently, all imports fell off sharply. Napoleon, keenly aware of the need for sugar and the ready energy it supplied his armies, ordered thousands of acres of French soil planted to sugar beets. He appropriated 1,000,000 francs for sugar beet culture and established six training stations for beet farmers. Within a short time France had 40 beet sugar factories producing at the rate of 3,000,000 pounds of sugar each year.

Unfortunately, after Napoleon's defeat at Waterloo, France's beet sugar industry, along with the rest of its economy, collapsed. But it was not long before the industry revived in Europe and spread to America.

California sugar pioneers The Santa Clara Valley Indians around Milpitas, California, probably extracted sugar successfully from beets even before Marggraf did. A species of sugar beet grew wild there, and the Indians were reported to have made use of these beets.

In 1775 a Spaniard named Fages who had explored California on several occasions wrote about the native tribes as follows: "Those of the Sierras made quantities of molasses, candy, and sugar that is not unworthy of the fame of these people, and it is extracted from certain species of vegetables which of themselves do not appear to promise much." But whatever the accomplishments of the Indians, they must have produced barely enough sugar for their own needs, for they never established a lasting industry.

Slaves and sugar The beet sugar industry in the United States grew out of the slavery issue. The Abolitionists of the North were determined to boycott all products made by slave labor. At that time America's sugar supply came from the cane fields of the West Indies and Louisiana which were worked almost entirely by slaves. Cane sugar thus fell under the Abolitionists' ban. Consequently America's first beet sugar factory was built in the 1830's at Northampton, Massachusetts. As it turned out, the Abolitionists' technical ingenuity did not match their crusading zeal, for the factory shortly failed.

Over the next 30 years 14 factories were erected in this country. But it was not until 1871 that Mr. E. H. Dyer built the first successful one in North America at Alvarado, California.

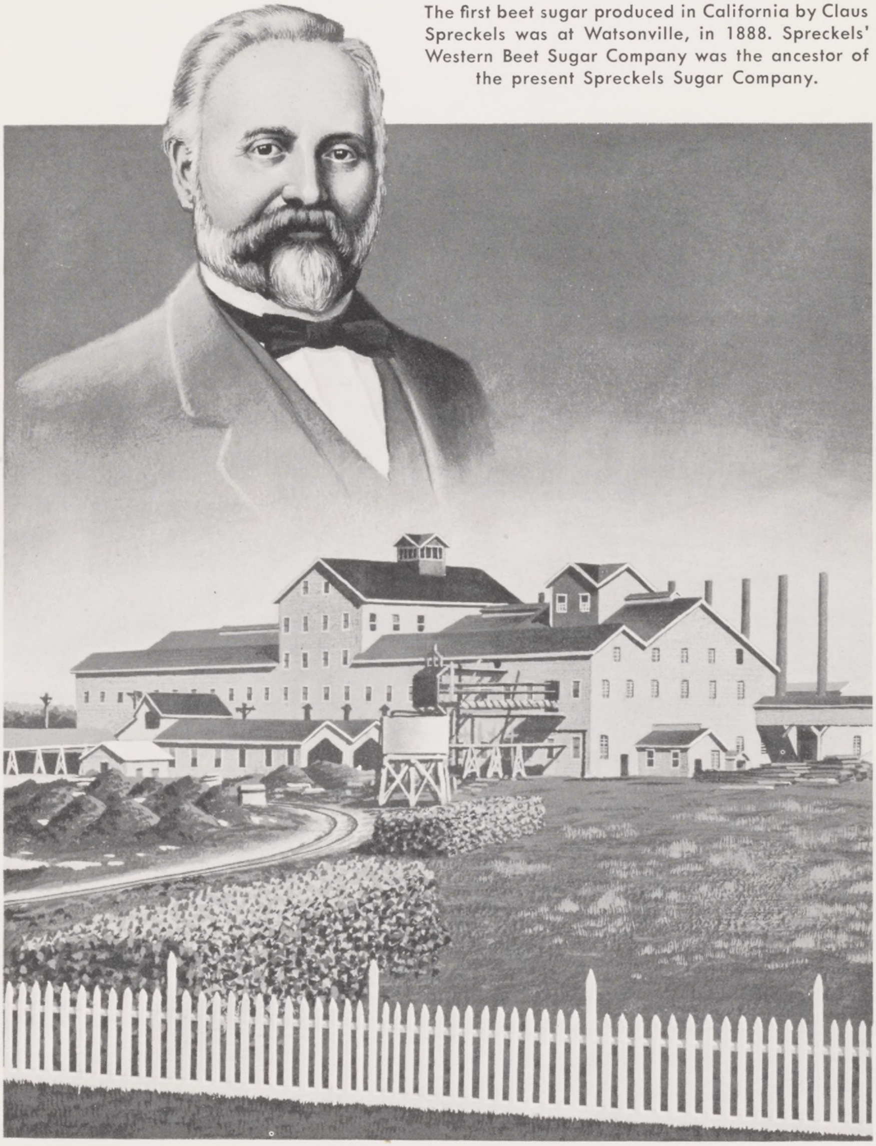
There were several attempts in the 1870's and 1880's in other parts of the country to duplicate Mr. Dyer's accomplishment, but all of them failed, mainly because of an inadequate supply of sugar beets. Out of these failures grew the belief that sugar beets could thrive only in the soils of California, a legend that later events have proved false.

Patron of beet sugar In the latter half of the nineteenth century Claus Spreckels, after rising from a grocery-store clerkship to become dominant refiner of Hawaiian cane sugar on the Pacific Coast, turned his attention to the possibilities of extracting sugar from sugar beets which could be grown in California. He went to Magdeburg in Germany and there he studied the beet sugar industry by working in factories. His training completed, he brought back to California a supply of sugar beet seeds, and selected experts to make trial plantings. By keeping careful records of the results of these plantings, he was able to determine the best potential areas for growing sugar beets.

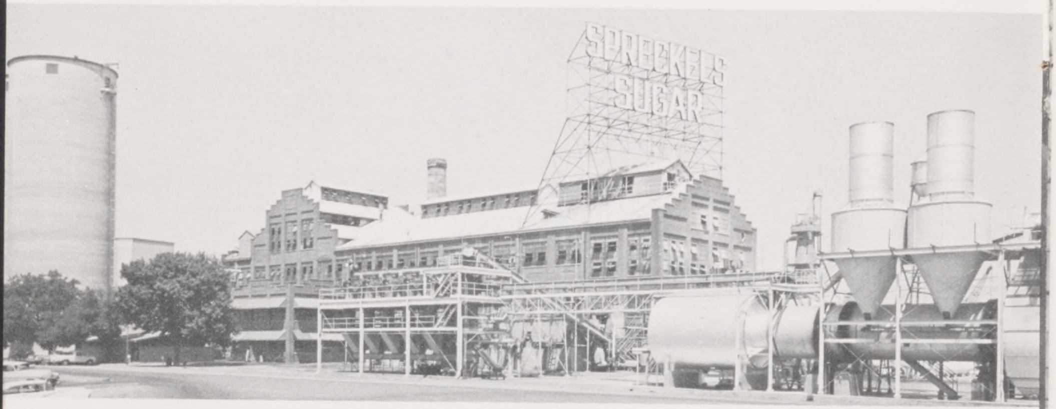
Then he surveyed the state for possible factory sites, settled on nine, and in 1887 chose Watsonville for the location of his first factory. Claus Spreckels' thoroughness and foresight are underlined by the fact that during the next 60 years a factory was erected on each one of the nine sites he had considered suitable.

Spreckels' Watsonville factory began operation in 1888 under the name of the Western Beet Sugar Company. It produced raw sugar which was refined to pure granulated sugar in his California Sugar Refinery in San Francisco. Each year its capacity was enlarged until in 1896 it processed 155,000 tons of beets and produced more than 19,000 tons of raw sugar.

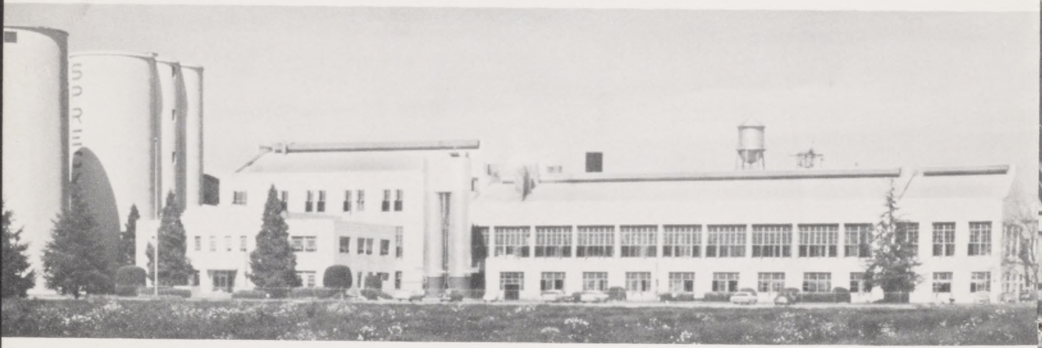
The first beet sugar produced in California by Claus Spreckels was at Watsonville, in 1888. Spreckels' Western Beet Sugar Company was the ancestor of the present Spreckels Sugar Company.



The original Spreckels Sugar Company Factory at Spreckels, near Salinas. Built in 1898.



The second factory, built at Manteca in 1917.



The third factory, built at Woodland in 1937.

The fourth factory, under construction near Fresno.

A new organization In 1897 Spreckels formed the company that still bears his name and built near Salinas what was then the world's largest beet sugar factory, capable of processing a record-breaking 3,000 tons daily. From its first year in 1899 until the present time this big factory has never missed a year's production. Thus the Spreckels Sugar Company has been serving western homemakers and food-processors for more than half a century.

In addition to the factory located in the town of Spreckels, the Spreckels Sugar Company operates two other plants—one at Manteca and the other at Woodland. The capacity of these three plants combined makes Spreckels Sugar Company the largest of all Pacific Coast beet sugar processors.

GROWING SUGAR BEETS

They help each other The relationship between the sugar-beet grower and sugar-beet processor is unique in several important respects.

Before planting, both parties sign a contract under which the processor guarantees to purchase the crop. This contract stipulates that payment to the grower for each ton of beets he delivers to the processor will be governed by two factors: (1) the average sugar content (percent sugar) of his beets, and (2) the net return received by the processor for each 100 pounds of sugar sold in a year's time. Thus a grower's income from his sugar beet crop is directly related both to the amount of sugar he has produced and to the market price of the finished product for which he has supplied the basic raw material.

The farmer who grows sugar beets signs a contract with the processor before planting.

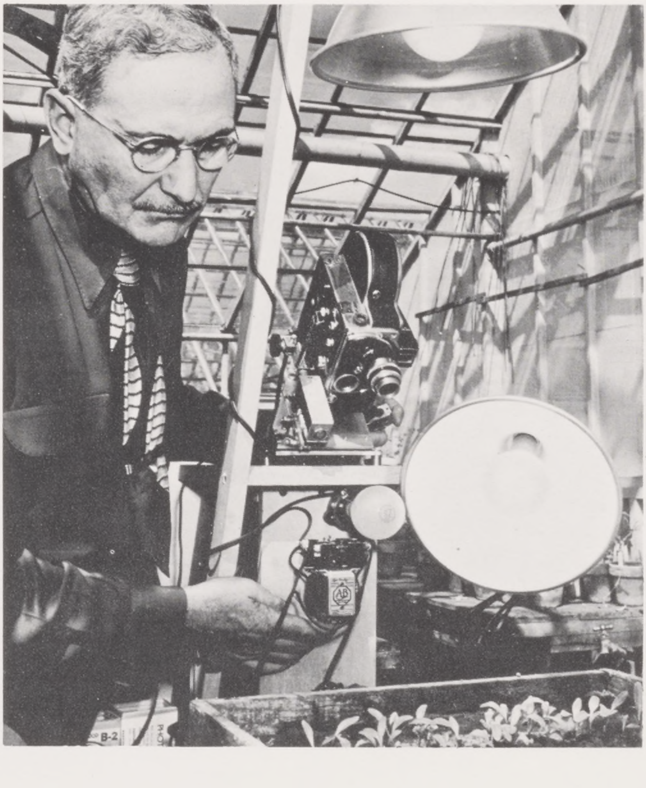
At planting time the processor provides the grower with the variety of sugar beet seed best suited to his particular soil and climatic conditions. Prior to distributing seeds to growers, the processor has treated them with ***fungicides*** and ***insecticides*** in order to afford the grower maximum protection for his beets.

The grower receives at no cost to himself the year-around services of a trained agricultural field man employed by the processor. In addition to offering technical information and advice, the field man takes samples of the grower's beets to ascertain the best time to start harvesting; assists the grower in locating needed equipment and field labor; and, under certain circumstances, arranges financing for the grower's crop.

Agricultural research The Spreckels Sugar Company offers another important service to growers in its never-ending program of research. Company scientists are constantly striving to develop improved varieties of seed that will produce sugar beets of greater size and sugar content, with increased resistance to disease and extremes in temperature. These scientists also conduct field experiments with an eye to improving methods of raising sugar beets. And they work closely with farm-implement manufacturers, designing and building machinery and equipment that will make sugar beets a still more economical and easier crop to grow.

Spreckels, in short, actively assists the grower in helping him to maximize his returns from sugar beets.

Spreckels technologists are dedicated to sugar beet research. Here a stop-motion camera records seedling growth.



Sugar beet seeds. Only a thimbleful, but locked within them is the heritage of a century and a half of breeding and selection. Each will grow into a beet containing up to half a pound or more of sugar.

From seed to beet While the growing season of sugar beets varies in different localities, the life cycle of the sugar beet in northern California serves as an interesting and typical example.

Sugar beet seeds are planted mechanically on ridges either in single or double rows. The ridges are usually irrigated to start germination.

In a few days the seed germinates, and one or two weeks after planting, *cotyledons* (embryonic leaves) push up through the surface of the soil.

It then becomes necessary to cultivate in order to eliminate weeds between rows of plants.

When the plants have at least four true leaves showing, the crop is thinned. Thinning is accomplished by chopping out enough of the beets so that the remaining plants will be six to ten inches apart, sufficient room to attain maximum growth. Recently mechanical thinning machines have simplified this part of beet culture, making it possible to eliminate tedious and costly hand labor. One mechanical thinner operated by a single tractor driver can do much of the work formerly requiring the labor of about 30 men.

A few weeks later crews come with long-handled hoes to remove weeds and excess beet plants. Irrigation is necessary at various stages of the crop's growth, the frequency depending on soil and weather conditions.

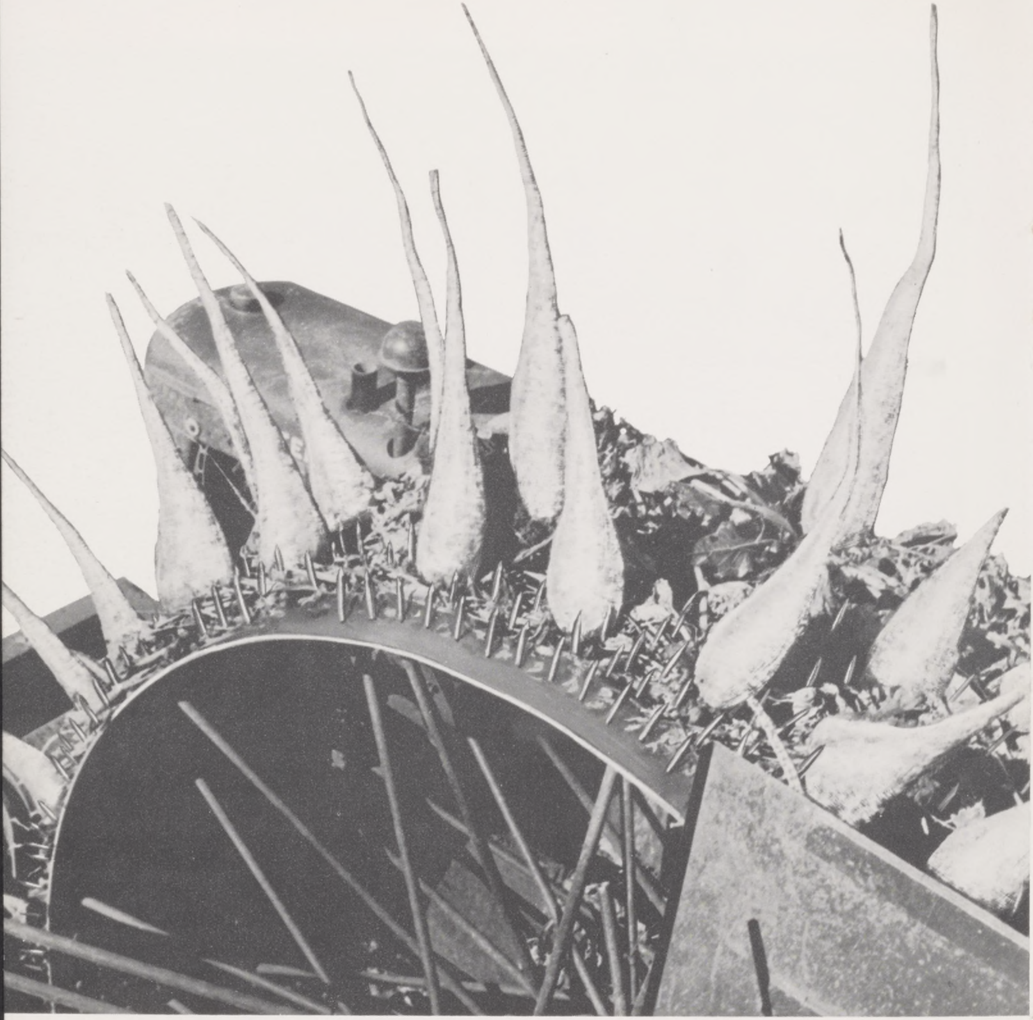
The sugar beet grower plants seed which has been carefully grown and treated by the sugar beet processor. The planter places the seed in straight rows, about an inch deep with seeds from 1 to 3 inches apart in the row.

Where rain is scarce and undependable, the planted seeds are germinated by irrigation water led to furrows between the rows.

Machines have been devised to thin out heavy stands of seedling beets, removing weeds and surplus beet plants, leaving well-spaced plants.

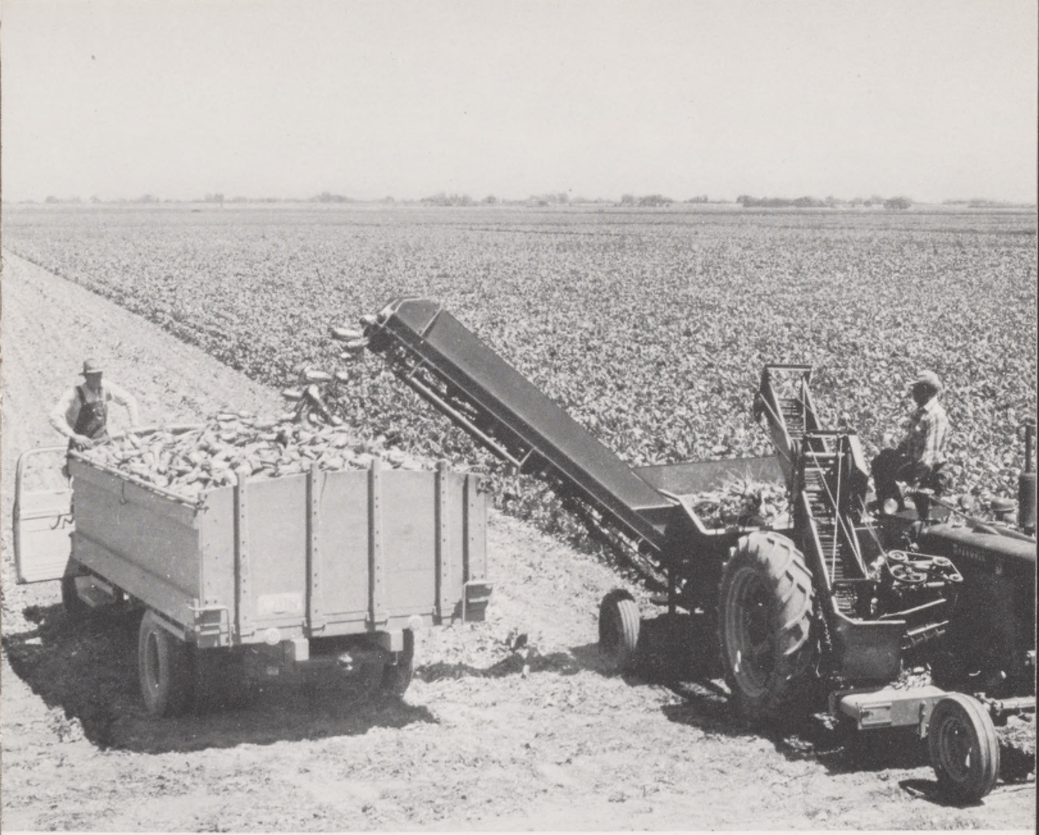
Harvest From six to nine months after planting, the beets are ready for harvest. Formerly a back-breaking job for field labor, harvesting is now done almost entirely by machines built especially for this purpose. A double-row sugar beet harvester with a crew of two men does the same amount of work as 30 experienced agricultural workers, at far less cost to the grower.

When are beets planted and when are they harvested? Until recently it was the practice in all beet-growing areas, except the Imperial Valley of California, for growers to plant beets in the winter or early spring and harvest them in the fall. Now, however, under a program pioneered by Spreckels Sugar Company, some growers in the Central Valley of California do their planting in the late spring or early summer and harvest their beets the following spring. Hence growers there have a choice of two different cycles for their sugar beet crops. This flexibility has made sugar beets a more attractive crop in the Central Valley, which in turn has served to ensure a stable supply of beets for the company's factories.



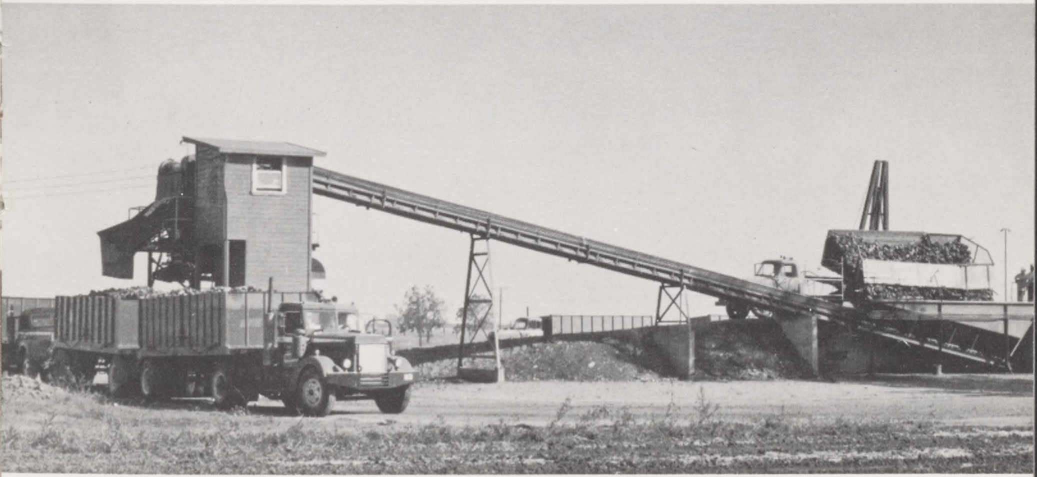
Beets are harvested by this machine whose 6-foot spike-studded wheels roll along the row, impaling roots that have been loosened by plow-shares carried underground beneath the wheels.

From field to factory When harvested, sugar beets are moved from the fields by the grower's trucks, each truck holding 6 to 12 tons of beets. The trucks carry beets to the processor's closest receiving station which may be located either at a factory or at a central point in a beet-growing area. A receiving station consists of a receiving hopper, scales, elevator belt, cleaning screen, and delivery conveyor. The receiving station crew discharges beets from the grower's trucks; weighs each load and takes from it a sample that is later analyzed to determine the average sugar content of the entire load; and, at outlying stations, feeds the beets into open railroad cars or large transport trucks that deliver them to the processor's factory.



(Top) Smaller, tractor-mounted harvesters of the spiked-wheel type gather the beets into a trailing cart which carries a ton or more, and self-discharges its load of topped beets to a waiting truck.

(Bottom) The truckload of beets is driven by the grower to one of the Company's 32 receiving stations. Here it is weighed, the beets are cleaned and sampled, and the grower credited with his delivery. The cleaned beets are then delivered to large transport trucks or to railroad cars for hauling to the nearest factory.



At the factory, beets are stored in bins that hold 6,000 tons. Flumes of rushing water serve to wash the beets as well as transport them into the factory.

FROM BEET TO SUGAR

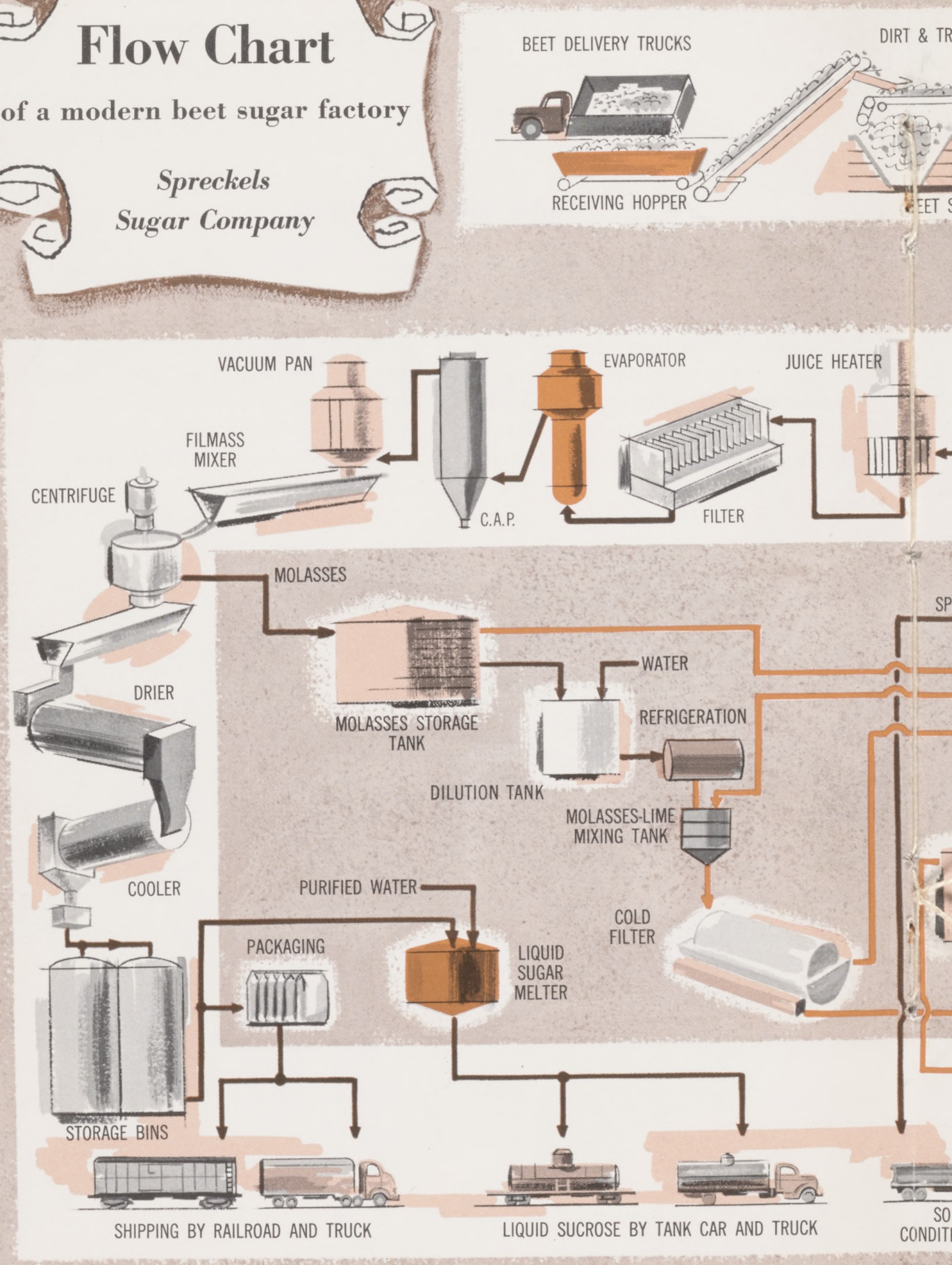
Cleaning and slicing On arrival at the factory, sugar beets are stored either in long, V-shaped bins or on concrete storage slabs. From there they go into a flume. Water carries the beets to the beet feeder wheel that regulates the rate at which they enter the factory. Next the beets are washed by powerful jets of water to separate any dirt that may be adhering to them. They are then removed from the water by a drag conveyor that lifts them into the factory where they are dropped into rotary slicers. These powerful slicers cut the beets into long, slender shreds that look like shoestring potatoes and are called *cossettes.*

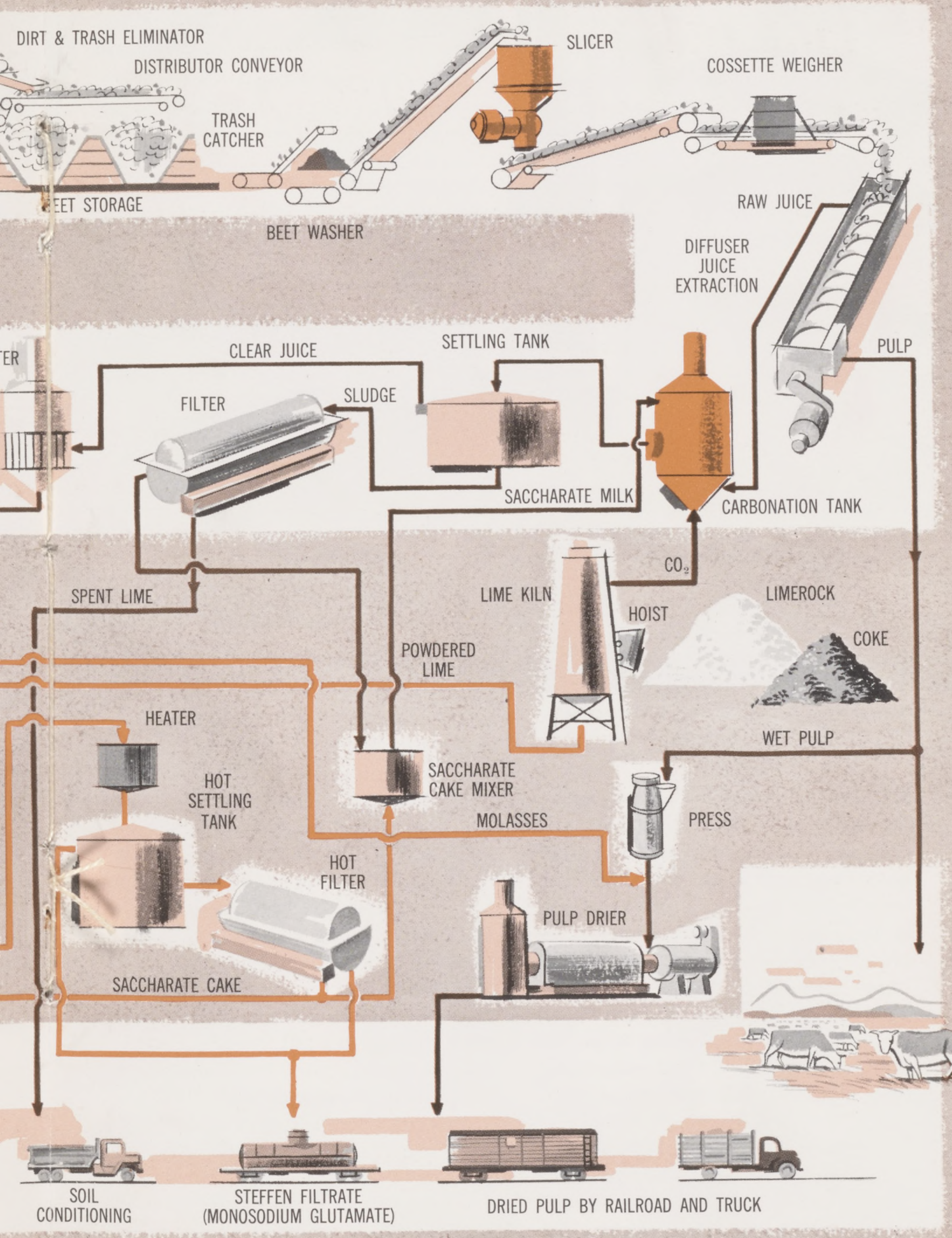
The clean, washed beets are sliced into shreds that look like shoe-string potatoes. These slices are called *cossettes.*

Process Flow Chart

of a modern beet sugar factory

Spreckels
Sugar Company




DIRT & TRASH ELIMINATOR
DISTRIBUTOR CONVEYOR
SLICER
COSSETTE WEIGHER
TRASH CATCHER
BEET STORAGE
BEET WASHER
RAW JUICE
DIFFUSER JUICE EXTRACTION
TER
CLEAR JUICE
SETTLING TANK
PULP
FILTER
SLUDGE
SACCHARATE MILK
CARBONATION TANK
CO_2
SPENT LIME
LIME KILN
HOIST
LIMEROCK
COKE
POWDERED LIME
HEATER
WET PULP
HOT SETTLING TANK
SACCHARATE CAKE MIXER
MOLASSES
PRESS
HOT FILTER
PULP DRIER
SACCHARATE CAKE
SOIL CONDITIONING
STEFFEN FILTRATE (MONOSODIUM GLUTAMATE)
DRIED PULP BY RAILROAD AND TRUCK

The cossettes are carried slowly through a bath of hot water. The sugar in the beet tissue *diffuses* into the hot water.

Diffusion The cossettes are whirled by the slicers through a steam bath and dropped onto a conveyor belt that transports them to the diffuser, which consists of 24 to 28 vats or cells connected in succession. Here they undergo the process that makes them give up their sugar. They are carried by scrolls from one cell to another against a continuous stream of hot water flowing in the opposite direction. The water soaks or diffuses sugar out of the cossettes.

The sugar-less cossettes, known as beet pulp, are expelled from one end of the diffuser to begin their journey through another process that will convert them into cattle feed. Simultaneously, from the other end of the diffuser comes the sugar in solution, or ***diffusion juice.*** It is blue-black in color and contains many impurities that have been soaked out of the cossettes along with the sugar. The next step is to purify this solution.

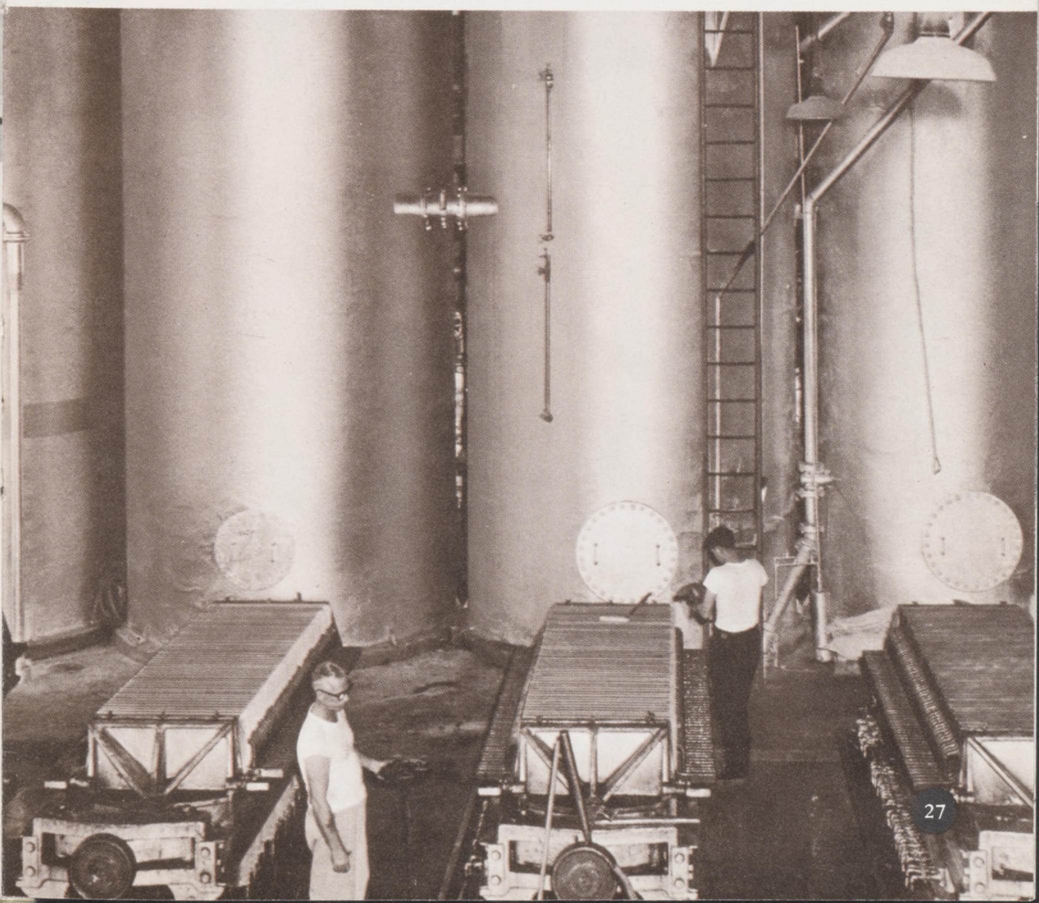
Carbonation In the process of carbonation, the diffusion juice is mingled with ***milk of lime*** in a tall, cylindrical tank. Carbon dioxide gas is bubbled through this mixture, causing the milk of lime to form small crystals of calcium carbonate that cling to impurities in the diffusion juice.

The agents of carbonation, lime and carbon dioxide, are manufactured in the lime kiln, a tall cone-shaped furnace located just outside the factory building. Here, lime rock and coke are mixed and burned. The heat from the coke causes the lime rock to decompose into calcium oxide (burned lime) and carbon dioxide gas. The carbon dioxide is pumped off the top of the kiln, while the burned lime is taken from the bottom of the kiln to be converted into milk of lime by the addition of water.

From the carbonation tank the sugar solution pours into a big, circular settling tank, where impurity-laden particles sink to the bottom. The liquid that remains at the top of the settling tank is carbonated again and then filtered. The resulting ***thin juice*** is golden in color, and contains 10 to 11% sugar.

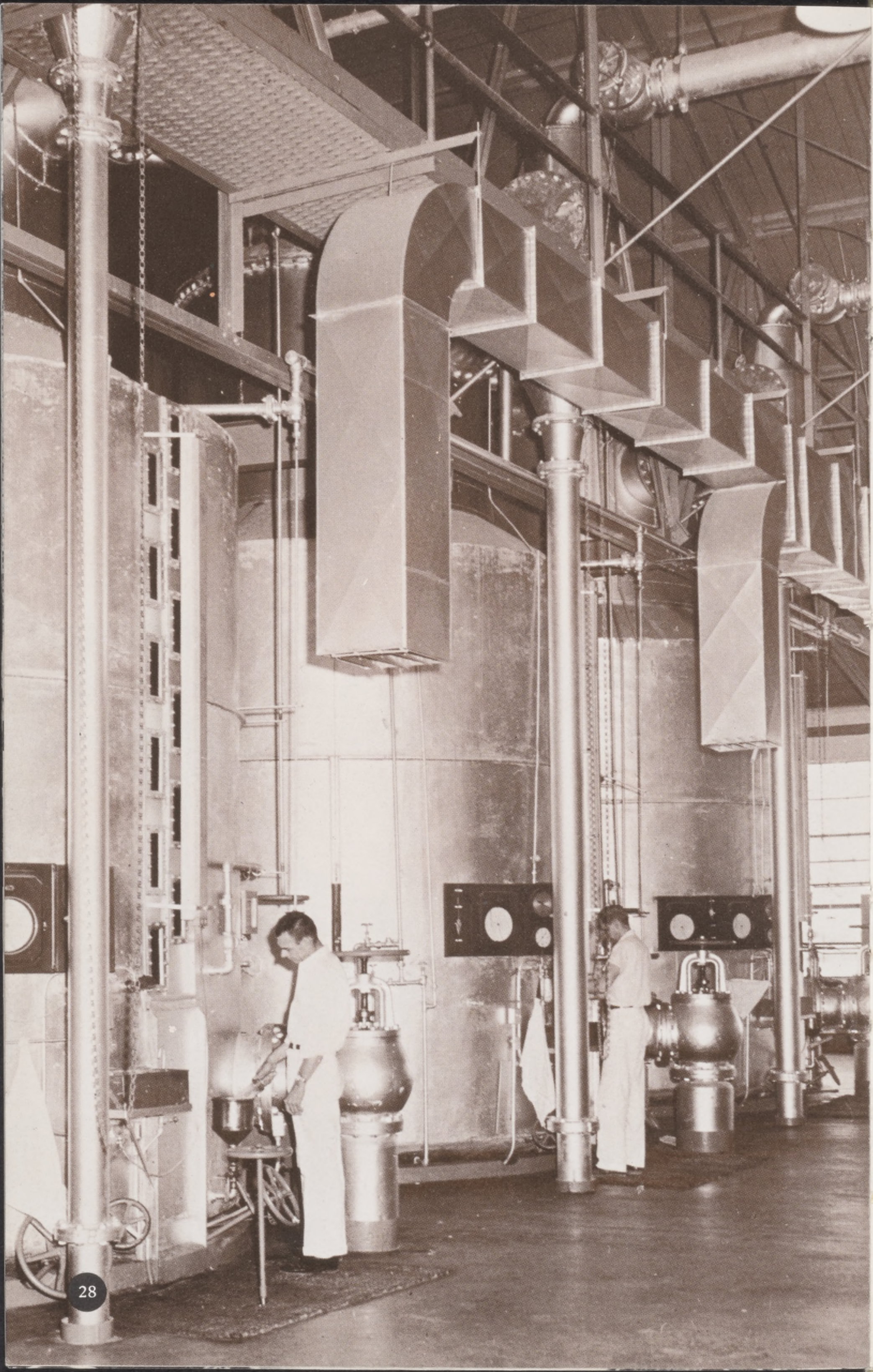
Evaporation Thin juice must be concentrated before the sugar in it can be crystallized, so it is sent through a series of evaporators that boil off some of its water. Thicker and darker after evaporation, the solution contains about 60% sugar. In this state it is known as ***thick juice.***

In 1958 the Spreckels Sugar Company installed at its Woodland factory a patented process for an activated carbon treatment known as the Continuous Adsorption Process. This new "CAP" system involves the percolation of granular activated carbon through an



Carbonation tanks each hold about 40 tons of diffusion juice to be purified. In the foreground are seen the plate-and-frame filters.

The purified juice is forced through heavy cotton cloth to remove the tiniest particles of impurities.



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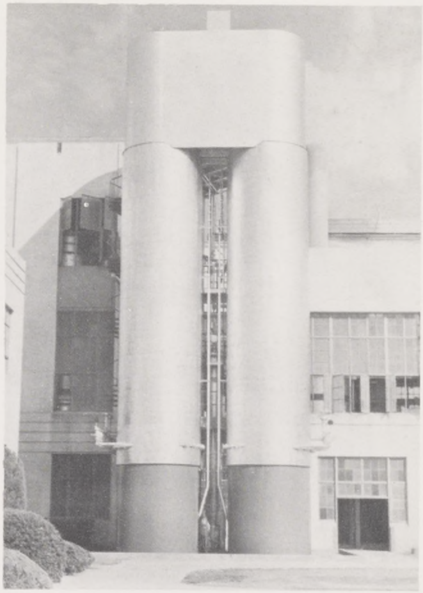
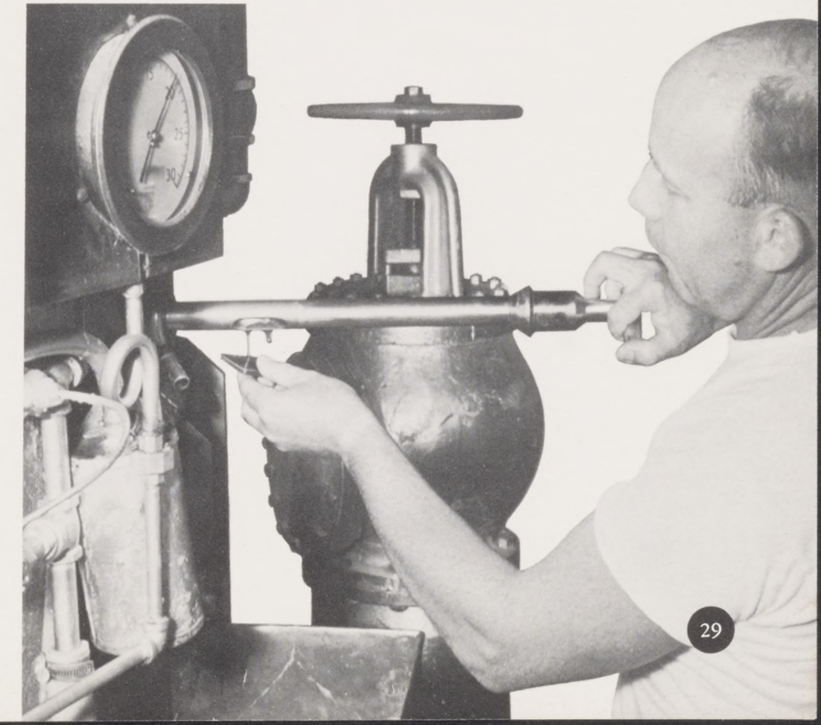
up-moving flow of "thick juice," and results in a brilliantly white sugar, and a crystal-clear solution which does not foam when boiled. The result, in addition to a favorable effect on production capacity, is a granulated sugar with exceptionally high quality characteristics.

The carbon-treated thick juice is heated and then fortified by the addition of intermediate and raw sugars that are continuously produced at a later stage of the process. The mixture now contains about 65% sugar and is called *standard liquor*.

Crystallization From here on sugar will begin to be crystallized. The standard liquor is filtered and then pumped into giant, cylindrical boilers called vacuum pans, where the solution boils at reduced pressure and temperature to prevent



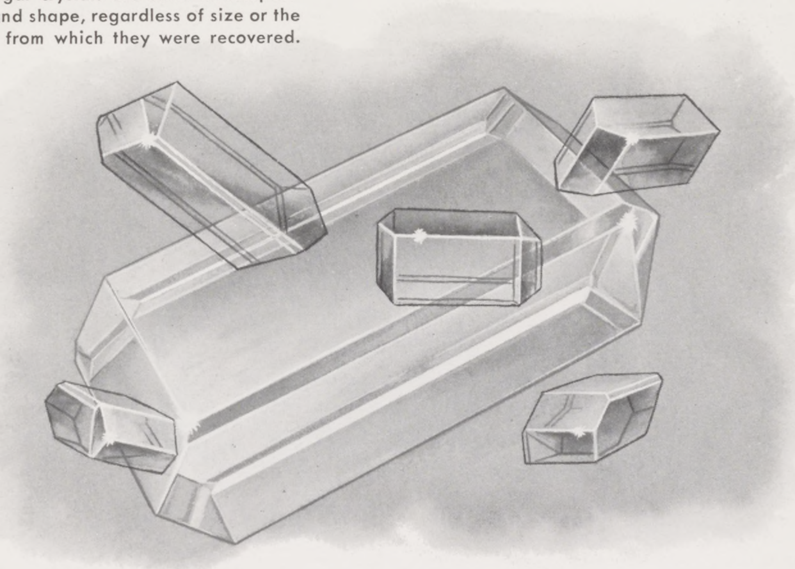
New Continuous Adsorption Process columns at Woodland. This process now in operation at all Spreckels' factories.



The sugar solution is finally boiled in vacuum pans. These are great kettles wherein the crystals form in the boiling syrup. Because a vacuum is maintained over the boiling solution, the temperature is much lower than if the solution were boiled in open air. This prevents discoloration or caramelization.

Crystal growth in the vacuum pan is carefully watched. The sugar boiler withdraws a syrup sample with his "proof stick", places it on a glass slide for examination under a microscope.

All sugar crystals are alike in composition and shape, regardless of size or the plant from which they were recovered.



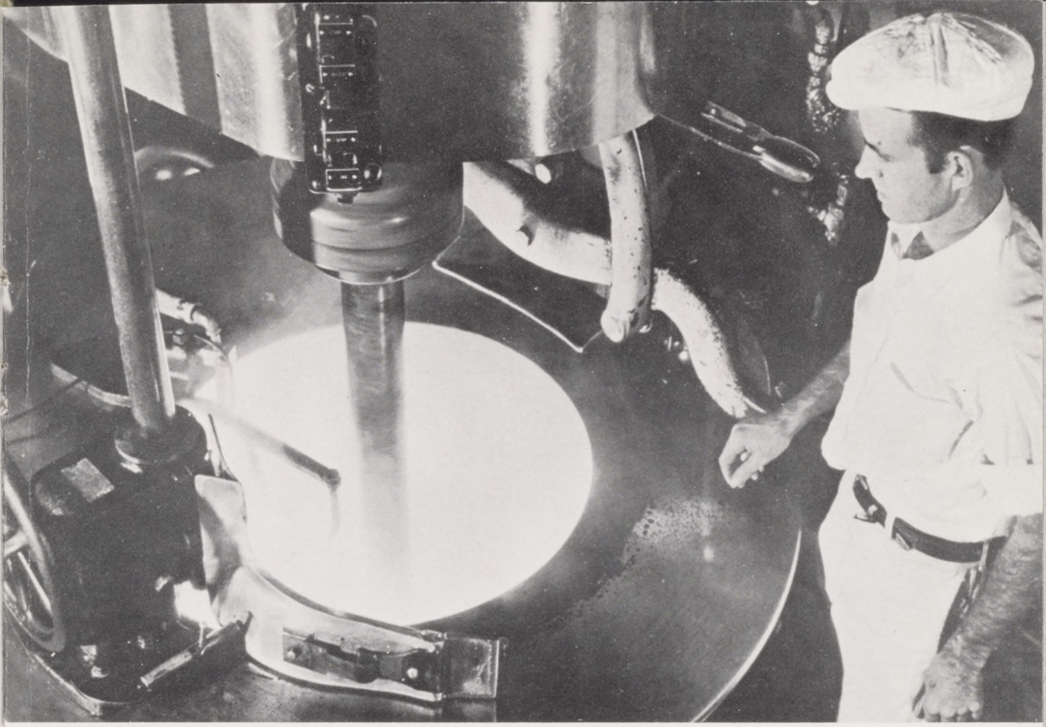
caramelization. The sugar solution is now saturated, which means that it holds the maximum possible amount of sugar solids and that when it is cooled sugar crystals will form. To begin crystallization, the solution is ***shocked;*** that is, a measured scoop of finely powdered sugar is added to it. This causes crystals to come into existence throughout the solution.

The sugar crystals are allowed to grow until they reach a proper and uniform size. A highly-skilled technician keeps constant watch in order to stop the growing process at exactly the right moment. He removes samples from the vacuum pan at intervals, and inspects them under a powerful microscope. Even after these crystals are full-grown they are still suspended in a heavy syrup from which they must be separated.

The mixture is now light brown in color and like melted fudge in consistency. It is called ***filmass.*** The filmass is stored in V-shaped tanks from which it is periodically drawn into large spinning baskets or centrifugals.

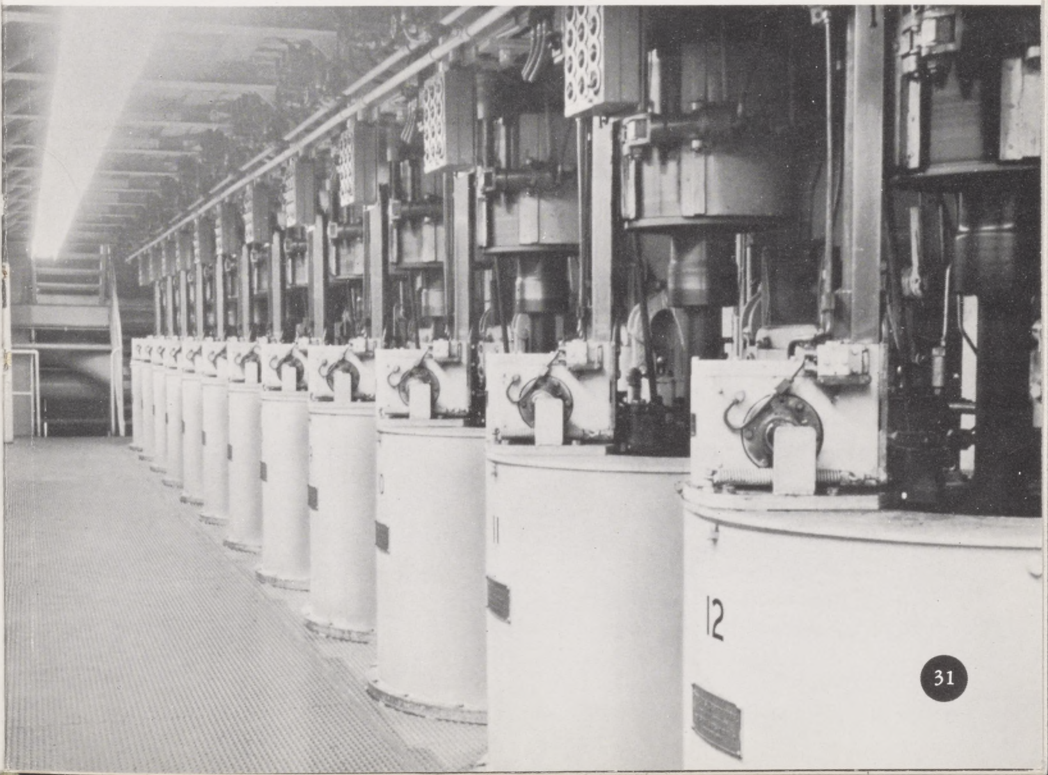
Centrifuging The centrifugals, whirling at great speed (1200 or 1800 RPM) throw the liquid out of the sugar crystals in much the same way that water is spun out of wet clothes in a "spin-dry" washing machine. A fine-meshed screen fitted to the wall of the spinning centrifiugal basket holds the sugar in and lets the liquid fly out. When the liquid has been removed, the crystals are washed clean with a hot water spray, the centrifugal is stopped, and its contents are dropped through an opening in the bottom to a scroll conveyor below.

The damp sugar crystals are dried by warm air blowing through a large rotating drum. Next they are shaken through a fine screen to insure uniform grain size and then they are stored in bulk or bagged or, if a special sugar is to be made, subjected to further processing. Altogether about six hours elapse from the time a sugar beet is dropped into a slicer until its sugar is finally screened.



(Top) Filmass—1,000 pounds at a time, whirls in the basket of the centrifugal machine. The molasses is flung away and pure white crystals remain.

(Bottom) In the newest sugar factories, centrifugals are entirely automatic; they complete the cycle of filling, spinning, washing and emptying without human aid.



The damp sugar is dried by warm air in revolving drums. Cascades of pure granulated sugar tumble from the drum's vaned lining.

Intermediate and raw sugars The liquid spun off the sugar crystals still contains considerable amount of dissolved sugar. So it is put through two more boilings and centrifugings. These produce the intermediate and raw sugars that, as already mentioned, are used to fortify the thick juice.

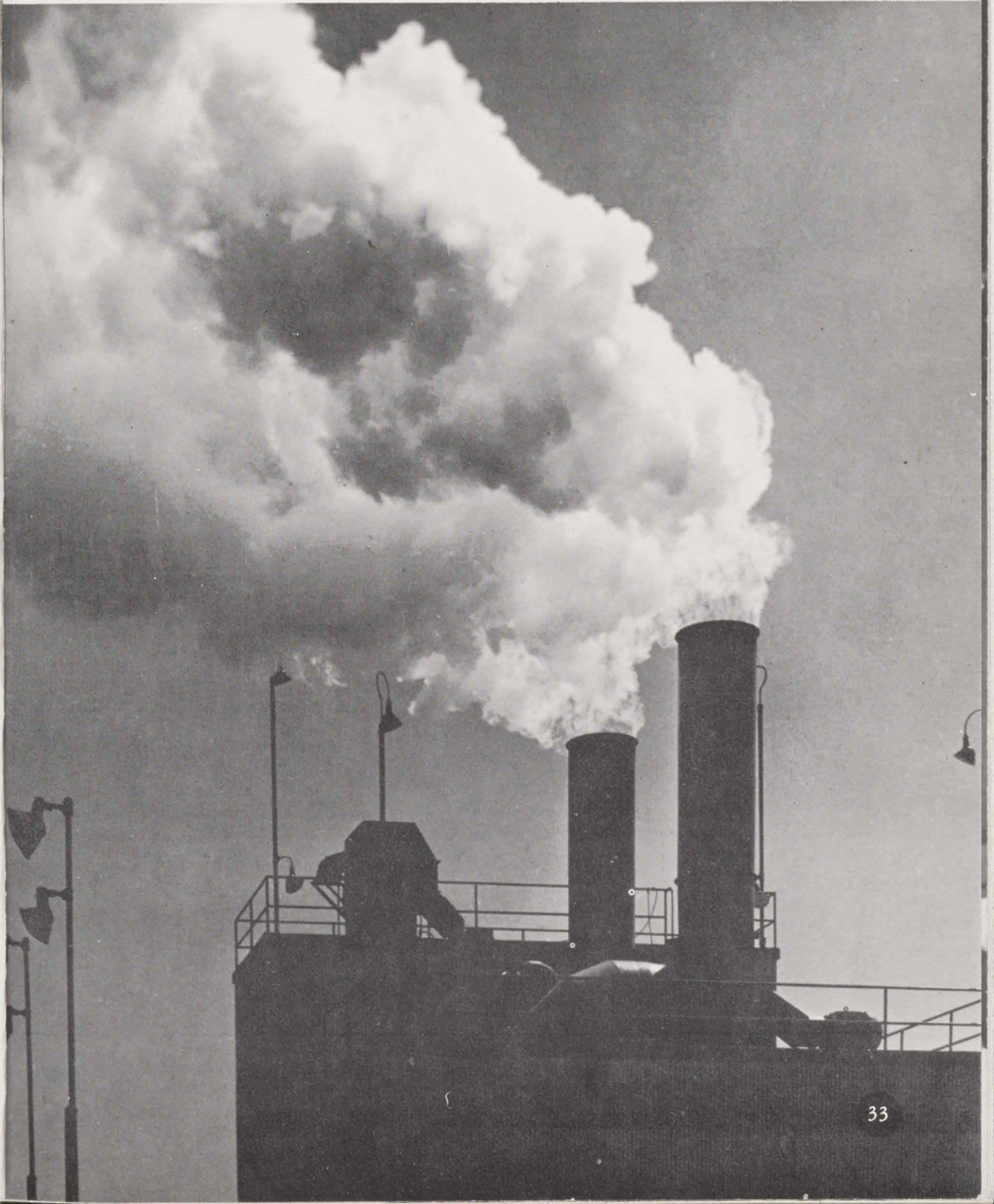
The Steffen house The dark, sticky syrup remaining after third-stage boiling and centrifuging is known as ***beet molasses.*** It contains some sugar, but this sugar cannot be economically extracted by further boiling and centrifuging. Some factories, however, are equipped with a Steffen house in which sugar is recovered from beet molasses.

Under the continuous Steffen process devised by Spreckels Sugar Company, beet molasses is diluted with water, and cooled to nearly freezing (4° C.) by a 500-horsepower refrigeration plant (the average electric refrigerator in the home requires one-eighth of a horsepower). Then, lime is added. At this low temperature the molasses gives up its sugar to the lime, a calcium saccharate being formed. Filtration then separates a solid mass called ***cold saccharate cake.*** The remaining liquid is heated, pumped to a settling tank, and filtered, leaving a second solid residue, ***hot saccharate cake.*** These two solids are blended to form a slurry, ***saccharate milk,*** which is now ready to be carbonated along with diffusion juice. In a factory equipped with a Steffen house this slurry takes the place of milk of lime in the carbonation process.

The campaign Sugar beets are a perishable crop, and therefore must be processed within a relatively short time after they are harvested, particularly in a warm climate such as that of California. Hence Spreckels' production schedule for each of its factories roughly coincides with the period of harvest in the growing areas that supply that factory with beets. The average production period at one of the company's factories is from four to five months a year.

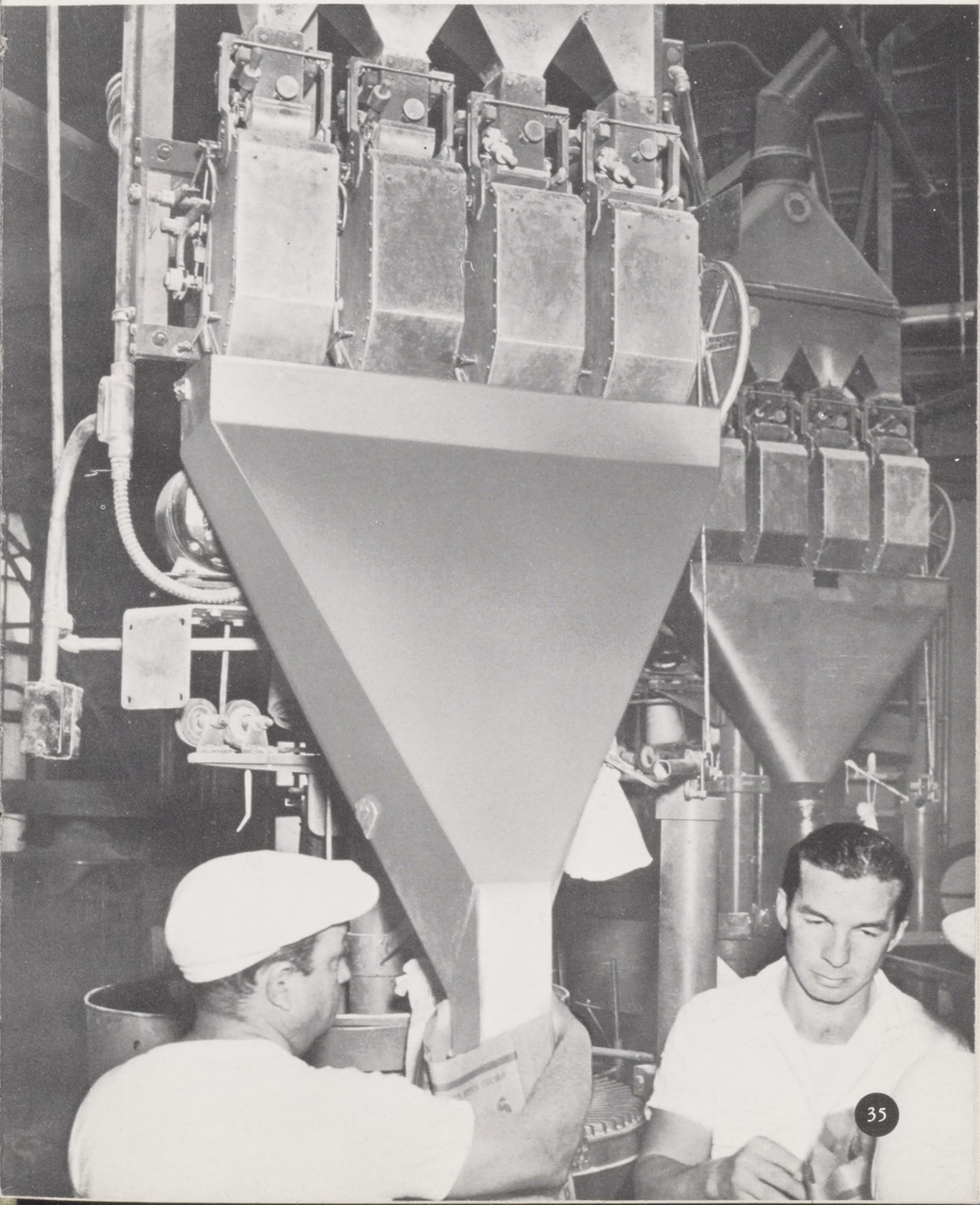
During the production period, known in the industry as the *campaign,* a sugar factory operates without interruption day and night, seven days a week.

Beet pulp is dried for cattle feed in great gas-fired dehydrators, which expel the moisture in impressive plumes of steam.

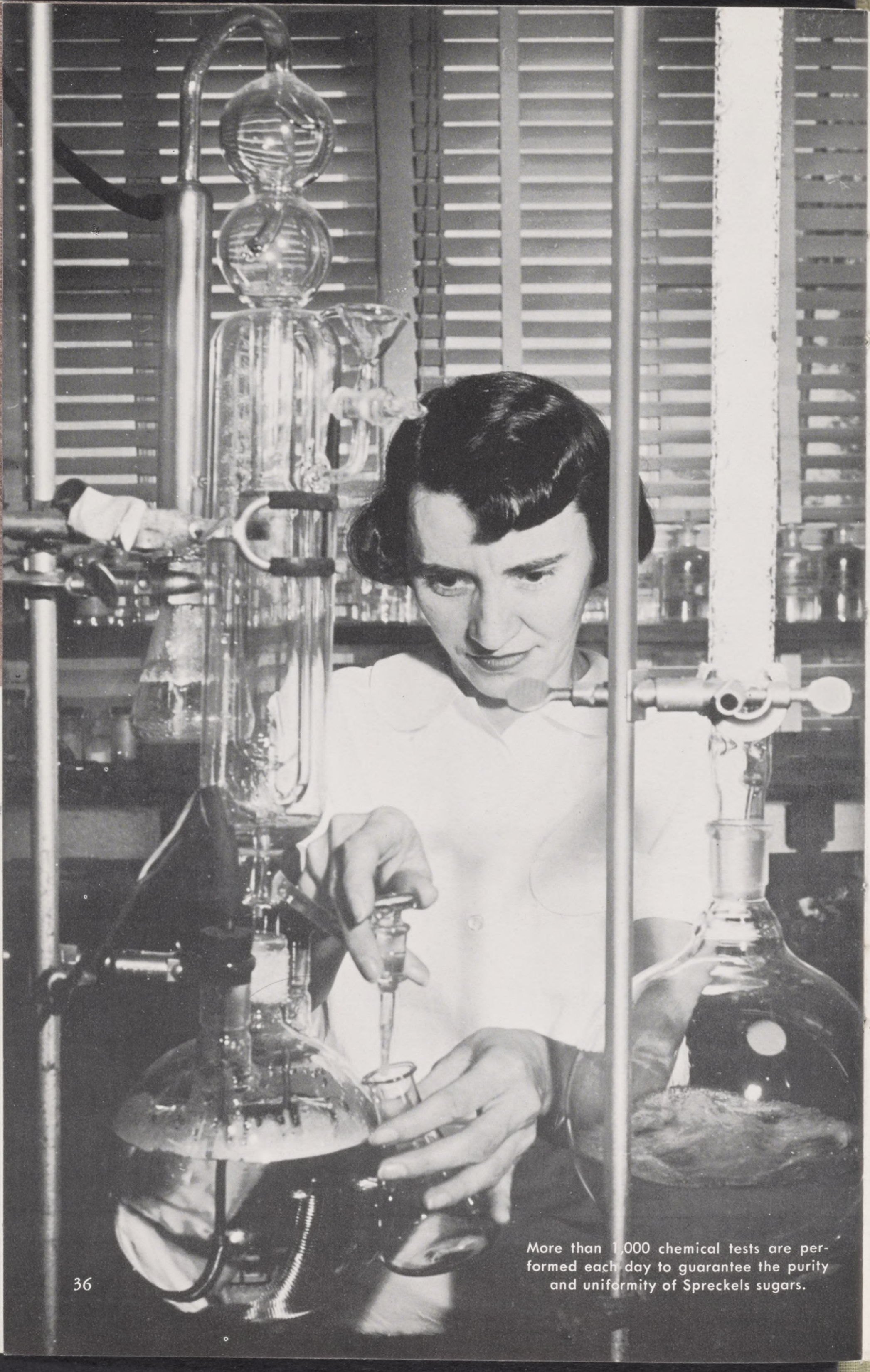


Packaging and storage Since a year's production is completed in several months, large storage facilities are needed at each factory. Sugar may be stored in bulk form in huge cylindrical bins whence it is later removed as needed to fill customers' orders. Or it may be packaged directly after drying and screening. Bags of sugar are piled in stacks in a warehouse next to the factory building.

High-piled bags of sugar fill the factory warehouses after each campaign.



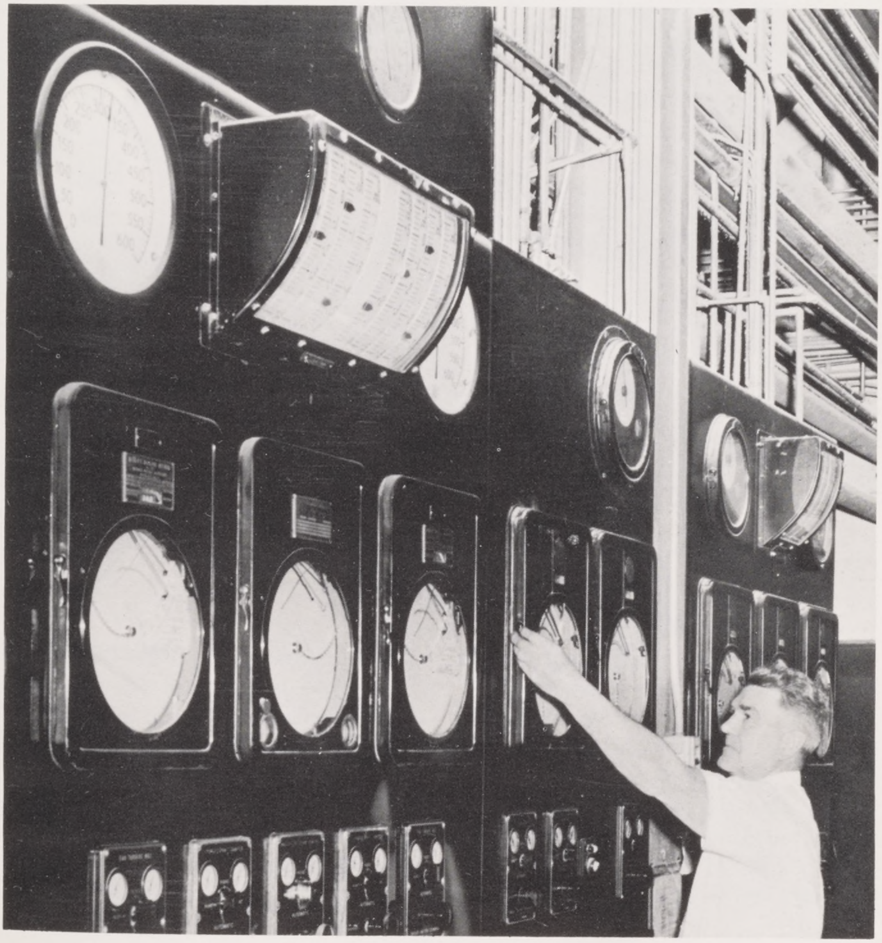
Paper bags are filled with exactly 100 pounds of sugar, automatically weighed. The bags are closed and sealed by machine.



More than 1,000 chemical tests are performed each day to guarantee the purity and uniformity of Spreckels sugars.

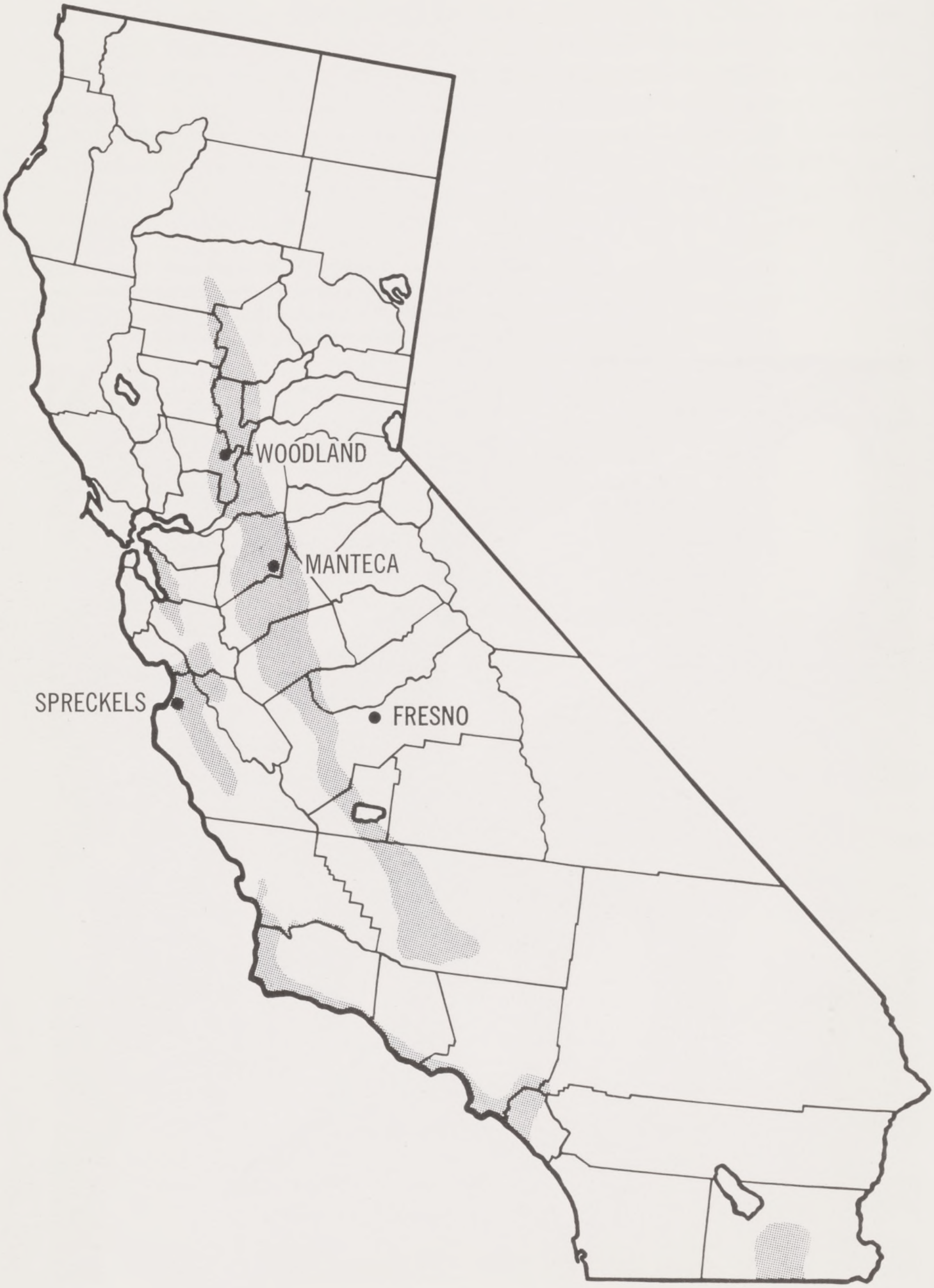
99.95% pure From the moment that sugar beets enter one end of the factory until packaged sugar emerges from the other, no human hands touch raw or in-process materials or finished products. Except for crystallization, factory operations are controlled by an elaborate array of instruments. Rigid standards are maintained by constant testing at each stage of the manufacturing process from the slicing of the beets to the screening of dry sugar. For example, the filtrate and precipitate separated at each filter station in the factory are analyzed in the control laboratory from one to 24 times a day. Sugar content, purity, color, turbidity are but four of the 30 different kinds of tests routinely run in the laboratory. In all, well over a thousand individual chemical tests are made during each day's operation. This constant and meticulous vigilance guarantees the consumer sugar products of unsurpassed purity, the true definition of quality.

Automation is not new to the beet industry. The skills of trained men are augmented by infallible automatic control devices like this complex array of steam generator control instruments at the Woodland factory.



Sugar Beet Growing Areas of California

● Spreckels Sugar Co. Factory



SUGAR PRODUCTS

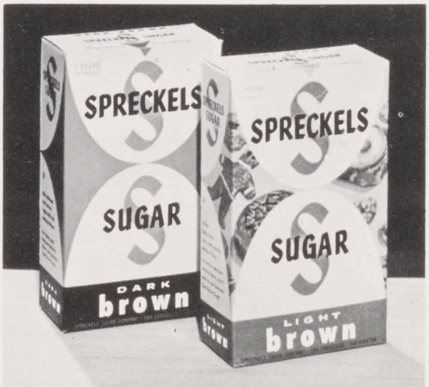
Granulated sugar The product emerging from the process just described is *granulated sugar*. It consists of tiny, perfect sugar crystals—6 to 8 million in each cupful. Granulated sugar accounts for over half the sugar produced by Spreckels Sugar Company each year. Sparkling pure, granulated sugar is not only suitable for table use, but also for jelly-making, canning, preserving, and for cake-baking and candy-making. The company offers it in a variety of bags and packages to meet the needs of its different customers: 100-pound, 50-pound, 25-pound, 10-pound, 5-pound and 2-pound bags and 1-pound cartons. Spreckels also makes deliveries of granulated sugar in bulk form to many industrial users with large sugar requirements.

Spreckels liquid sugar travels directly from the factory where it is produced to its users in the Company's own fleet of tank trucks.

Liquid sugar has been rapidly growing in popularity in the West, especially among seasonal fruit canners. Its users enjoy several advantages. Handling is reduced, the floor space of their plants can be better utilized, and the sugar they use can be more accurately measured. Spreckels offers both ***sucrose syrup*** and ***invert sugar syrups*** to canners, bottlers, and other industrial users.

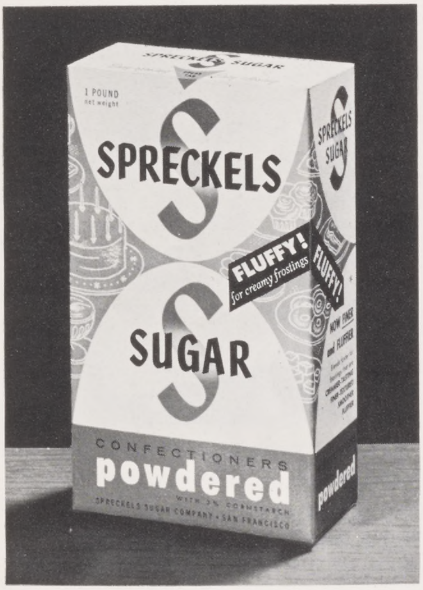
Sucrose syrup is made by dissolving granulated sugar in chemically purified water. It contains 66.5% sugar solids. Invert sugar syrup is made by heating sucrose syrup in the presence of a catalytic agent. This causes the sucrose to change its structural form; it is transformed into equivalent parts of the chemically simpler sugars ***dextrose*** and ***levulose.*** The final solution contains from 68% to 77% sugar solids, depending on the extent of inversion. Neither sucrose syrup nor invert sugar syrup will crystallize under normal conditions.

Brown sugar or "soft" sugar is offered to the industrial trade by Spreckels in 100- and 25-pound bags. The household consumer may choose between Spreckels' 1-pound wax-lined carton of ***light brown*** and the 1-pound carton of ***dark brown.*** Most recipes calling for brown sugar assume the sugar is packed tightly in the measuring cup.

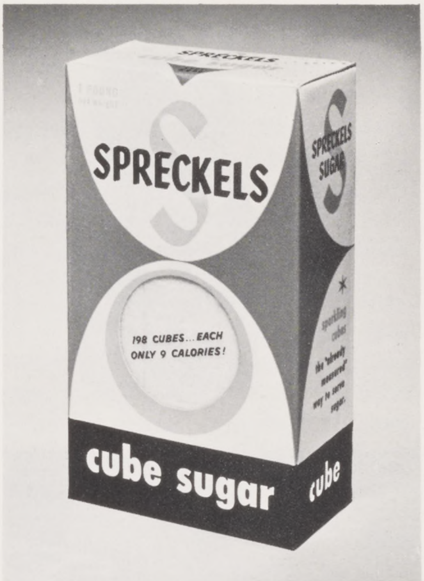


Confectioners powdered sugar is pulverized granulated sugar with a small amount of starch added to prevent caking. Spreckels' powdered sugar is available in the same-sized containers as its brown sugar; 1-pound cartons that are wax-lined to exclude moisture, and 100- and 25-pound bags for industrial use.

Powdered sugar should be stored in a place where both temperature and humidity are uniform. Most recipes calling for powdered or confectioners sugar require the sugar be passed through a strainer or sifter *before* measuring.

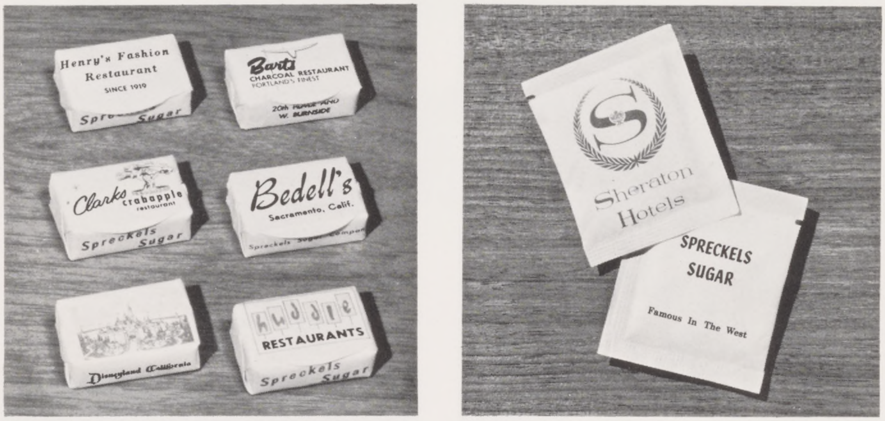

1 POUND
net weight
SPRECKELS
SUGAR
FLUFFY! for creamy frostings
CONFECTIONERS
powdered
SPRECKELS SUGAR COMPANY • SAN FRANCISCO

Superfine sugar can be obtained in 1-pound cartons. It is a very small-grained sugar which dissolves rapidly in liquid. It is excellent for cake batters, icings, and mixed drinks, or for sweetening fresh berries or fruits. Superfine sugar also comes in individual packets that can be imprinted with the emblem or crest of any institution (restaurant, drive-in, hotel, etc.) using them. ➡



Cubes are formed by pressing moist sugar into individual molds in a rotating cylinder and then baking the pressed sugar until dry. Spreckels' 1-pound carton of cubes enjoys wide popularity with western sugar users.

Sugar and Cinnamon is a mixture of cinnamon from the tropics and instant-dissolving superfine sugar. For extra convenience it is packed in a glass container with a shaker top.



Individual Services
Wrapped Tablets and Packets are produced for the restaurant and hotel trade. Their wrappings can be imprinted with institutional emblems or crests.

SPRECKELS
SUGAR
bottlers
SPRECKELS SUGAR COMPANY · SAN FRANCISCO
100 POUNDS NET
SPRECKELS
SUGAR
bakers special
SPRECKELS SUGAR COMPANY · SAN FRANCISCO
100 POUNDS NET

Bottler's Granulated Sugar has an extra coarse grain. This is desirable for the manufacture of many beverages because it can be blended with cold water in the preparation of clear syrup.

Bakers Special is a sugar with a very fine grain suitable for the commercial baking of cakes, pastries, cookies and so forth. Both Bakers Special and Bottler's Granulated Sugar are available in 100 pound bags.

BY-PRODUCTS

Beet tops The top (crown and leaves) is removed from the root of the beet either just before or during harvesting operations. Beet tops abound in nitrogen, and are either plowed back into the ground to enrich the soil or are fed to livestock.

Beet pulp. Beet pulp is an excellent livestock feed and can either be fed in the form in which it comes out of the diffuser after a period of curing in an open silo *(wet beet pulp)* or blended with molasses and dried *(molasses dried beet pulp)*.

Molasses, which is the syrup remaining after third-stage boiling and centrifuging, is a desirable ingredient for the manufacture of alcohol, yeast, and citric acid, and can be used as a livestock feed, either alone or blended with beet pulp. But many beet sugar factories, as indicated previously, extract additional sugar from molasses by the Steffen process.

Concentrated Steffen filtrate Until recently, the final filtrates of the Steffen process were discarded. But now, like diffusion juice, they are carbonated, filtered, and evaporated. The end product, *concentrated Steffen filtrate,* is shipped to a plant of Ac'cent International, a division of International Minerals and Chemical Corporation at San Jose, California. There it is further processed to make monosodium glutamate, a popular food flavor-enhancer marketed under the trade name of "Ac'cent."

Lime Quantities of lime are accumulated at several filter stations in a beet sugar factory. Many farmers use this lime as a conditioner and anti-acid agent for their soil.

SUMMARY

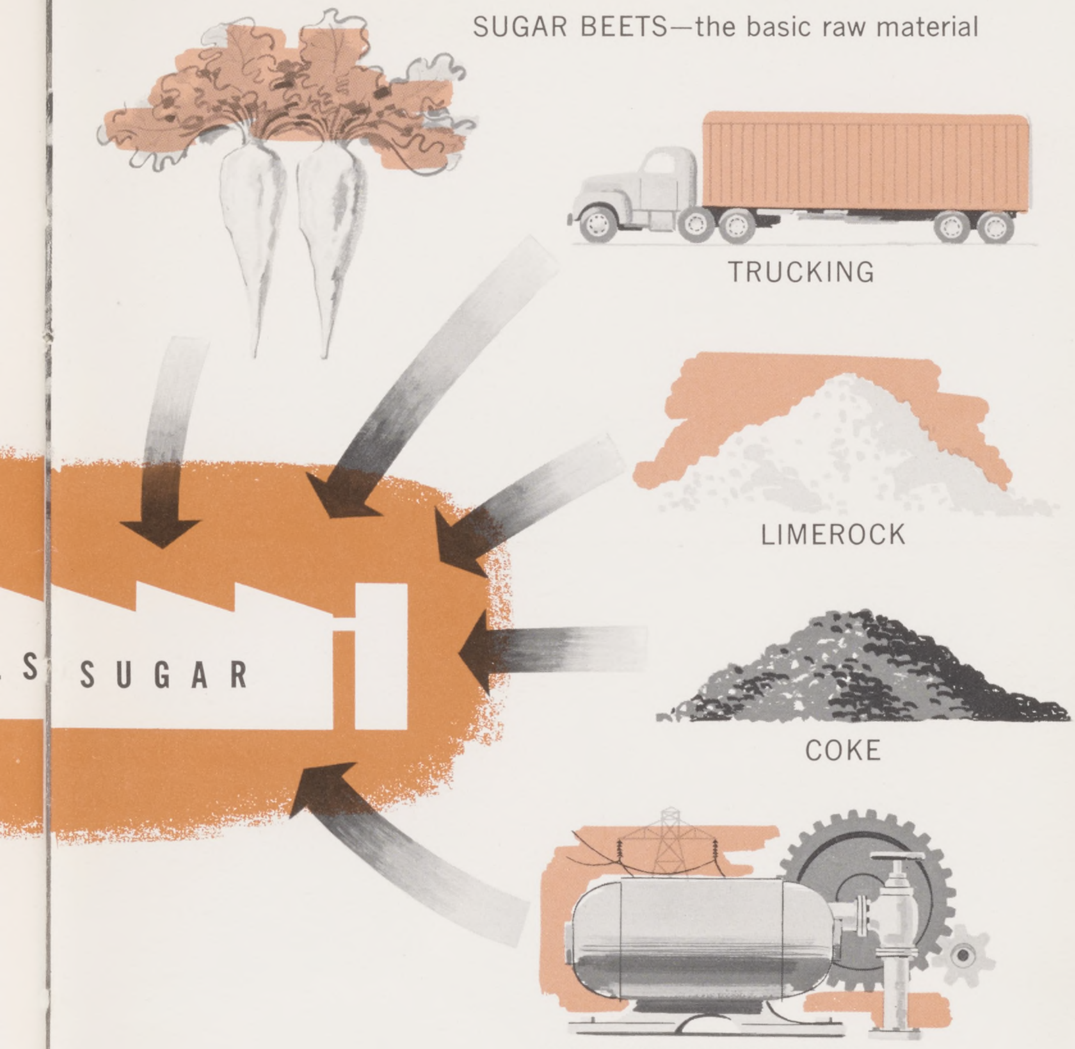
Sugar has been part of the diet as long as men have consumed fruit and other sugar-containing plants. The extraction of sugar from cane has been carried on for centuries, but it is only in the last four and a half centuries that this has been accomplished on a large enough scale to make sugar common as an individual and distinct food. In modern times its universal appeal to the taste and appetite, either alone or in combination with other foods, has made sugar a matter of concern to statesmen, traders, and scientists.

Sugar beets have been depended upon as an important source of sugar for a little over a century. In that relatively brief period they have come to account for two-fifths of all the sugar produced in the world each year. Almost every country in the temperate zone boasts a beet sugar industry.

In the United States the growing and processing of sugar beets is concentrated in the western part of the country, with California leading all other states. Here the Spreckels Sugar Company transforms sugar beets into a full line of consumer and industrial sugars to meet the needs of every kind of sugar user. As exemplified in the development of the "CAP" process, never-ending research projects by Spreckels contribute to the technological advancement of the beet sugar industry as a whole. Westerners can take pride in this pure beet sugar grown and processed at home—a product that is second to none in quality from an agricultural industry beneficial to the economy of the nation.

A FAR-REACHING INDUSTRY

A beet-sugar processor like Spreckels requires a vast array of goods and services to make the sugar and by-products it offers for sale. In addition, many people are needed to operate and maintain its factories. Spreckels' employees chalk up over 2,000,000 man-hours of work in a year's time.



Of course the biggest single item Spreckels buys is sugar beets—$20,000,000 worth a year. Then there are payments to railroads and trucking firms, both for transporting sugar beets to the company's factories and for transporting sugar to its customers. All this comes to $2,700,000 each year. During a campaign the company's factories use some 60,000 tons of limerock and 7,000 tons of coke, which together cost $500,000. Another $1,000,000 go for gas and electricity. Sugar bags and other packaging materials are required in abundance. So are chemicals and filter materials.

These are just a few important examples of the many businesses and industries that Spreckels relies upon for raw materials. They are sufficient to suggest, however, that the company belongs to an industry whose economic benefits are indeed far-reaching.

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